



Solid State Circuits Inc. Site Republic, Missouri Greene County

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Site Description

The Solid State Circuits Inc. (SSC) site is a former printed circuit board manufacturing facility that operated in downtown Republic between 1968 and 1973. SSC operated in the northern portion of a late 19th-century grain mill building located at the southeast corner of Elm and Main streets. The manufacturing process involved the use of trichloroethylene (also known as trichloroethene or TCE) as a cleaning solvent, which was stored and used in the building's basement. A TCE release from the facility into the environment caused a TCE groundwater plume. A fire destroyed the building in 1979, and building debris was pushed into the basement. The property is currently an undeveloped lot surrounded by fencing. The land bordering the site is a mix of commercial, industrial, and residential properties.

In 1982, the Missouri Department of Natural Resources conducted public drinking water sampling as part of the Environmental Protection Agency's (EPA) National Synthetic Organic Chemical Survey. Sampling results detected TCE in City Well #1, located 600 feet south of the SSC facility; the city immediately took the well out of public use. A subsequent investigation conducted by SSC identified the facility as the source of TCE contamination in the well. There has been no detection of TCE in any of Republic's other public or private wells.

The Missouri Remedial Action Corporation Inc. (MRAC), an entity formed following a series of corporate successions and acquisitions by SSC, is performing the site investigation and cleanup. In 1986, EPA placed the SSC site on the National Priorities List. Since then, the Department has overseen site investigation and cleanup actions conducted by MRAC.

Description of Contamination

The primary contaminants of concern at the SSC site are TCE and related chemicals that form when TCE breaks down in the environment. Exposure to TCE has been associated with a number of adverse health effects. Additional information about the health effects of TCE exposure are available in the Agency for Toxic Substances and Disease Registry's fact sheet: atsdr.cdc.gov/toxfaqs/tfacts19.pdf

The exact volume of TCE released, and how the releases occurred at the site are not known; however, sampling data indicate that TCE entered the subsurface at the facility through sumps and floor drains located in the building's basement. After traveling vertically through 10-15 feet of clay soil, TCE traveled horizontally within the upper portion of the bedrock surface, which has fractures and karst features such as underground openings, losing streams, and springs (common geologic features in southwest Missouri and in the Republic area).

It is believed that an old well with a deteriorated casing in the building's basement allowed TCE to travel vertically several hundred feet into the deeper drinking water aquifer where City Well #1 pulled it in. EPA plugged this basement well shortly after discovering it in 1985.

In the 1980s, EPA detected TCE contamination in soil next to the facility. In 2010, MRAC discovered additional TCE contamination in the area. Additionally, MRAC detected TCE in soil along subsurface sewer lines south of the facility, where presumably it moved out of the sewer through gaps in pipe seams and broken portions of the aging clay tile sewer pipe. TCE vapors from the soil contamination are presumably entering the sewer, leading to concerns about TCE vapors getting into buildings connected to the sewer south of the former facility. The Department and MRAC believe that TCE was discharged to the sewer when the facility was active.

From 2007 to present, MRAC has conducted several sampling efforts to evaluate the potential for TCE vapors to travel through the subsurface and enter overlying structures, a process known as vapor intrusion (VI). TCE vapors can enter structures at the site in two ways: by traveling within soil gas beneath building foundations or crawlspaces, then entering through utility accesses, sumps, floor drains, foundation cracks, and seams; or by travelling through sewers, then entering through poorly sealed plumbing connections.

Between 2018 and present, MRAC implemented several vapor-reduction measures at the only residence where TCE was detected to try to minimize potential health impacts on residents. These measures included installing equipment to purify air inside the building and remove vapors from beneath the building. In November 2020, MRAC conducted a smoke test at the residence, which showed sewer vapors were entering the basement through a faulty plumbing connection. In December 2020, MRAC repaired the home's plumbing. Follow-up smoke testing and indoor air testing showed that the connection had been successfully sealed and was preventing further sewer vapor infiltration into the residence. In 2021, MRAC will conduct additional indoor air sampling at this residence to assess the effectiveness of these measures.

A separate fact sheet with additional information about VI is available from the Missouri Department of Health and Senior Services at:
health.mo.gov/living/environment/hazsubstancesites/pdf/VaporIntrusion.pdf

Investigation and Cleanup Activities

As shown in the site map below, the site is organized into four areas: Area 1 is the parcel where SSC operated; Area 2 includes the Main Street corridor between Area 1 and the former location of City Well #1; Area 3 includes the area around former City Well #1; and L-shaped Area 4 extends farther south along the Main Street corridor before extending east along Brooks Street.

Following is a summary of site-related investigations and other actions:

- Soil Investigations:

Between 1985 and 2018, MRAC collected and analyzed more than 400 soil samples from multiple boring locations and multiple depths, in all four areas. Results showed the highest TCE levels were in the soil directly beneath the former manufacturing building and in several locations near underground sewer lines to the south, along Main Street.

- Soil Cleanup:

In 1985, EPA excavated more than 2,000 cubic yards of contaminated soil and building debris from the facility's basement and the surrounding area, and transported it off-site for disposal at an approved facility. In 2012, MRAC treated approximately 2,500 cubic yards of contaminated soil in Area 1 by physically mixing the soil in place with a substance designed to reduce TCE. In 2015, MRAC treated approximately 6,000 cubic yards of contaminated soil in Areas 2 and 3 by injecting substances into the soil to reduce TCE and its breakdown chemicals. In 2020, MRAC treated an additional 2,900 cubic yards of soil in Area 1 by injecting a combination of treatment substances into the subsurface to further reduce TCE and its breakdown chemicals.

In 2021 and 2022, MRAC will conduct soil and shallow groundwater sampling in Areas 1, 2, and 3 to evaluate the effectiveness of the 2015 and 2020 subsurface injections.

- Groundwater Investigations:

To date, EPA and MRAC have installed more than 50 groundwater monitoring wells at the site, as shown in the attached map. Regular well sampling has identified TCE and its breakdown chemicals in groundwater extending south of the former facility, primarily along the Main Street corridor to U.S. Highway 60. MRAC plans to install additional groundwater monitoring wells in 2021 to define the impacted groundwater's boundaries.

- Groundwater Cleanup:

In 1993, MRAC installed a groundwater recovery and treatment system. The system consisted of six groundwater extraction wells, four of which were within Area 1 and two were between Area 1 and U.S. Highway 60. The system stripped TCE from extracted groundwater before discharging it to the sewer. However, the system's effectiveness dropped significantly after the initial 10-15 years of operation. Since a 2011 fire destroyed the treatment system, MRAC has conducted groundwater extraction only at the southernmost extraction well, located near U.S. Highway 60. TCE levels in the recovered groundwater from that location are low enough to allow direct discharge of untreated recovered groundwater directly to the sewer.

In 2015, MRAC also treated contaminated groundwater in Areas 2 and 3 by injecting substances into the subsurface to degrade TCE and its breakdown chemicals. In 2020, MRAC treated groundwater in Area 1 by injecting a combination of treatment substances to reduce TCE and its breakdown chemicals.

MRAC will sample groundwater in Areas 1, 2, and 3 to assess the effectiveness of the 2015 and 2020 treatments in those areas. Additionally, following installation and testing of additional monitoring wells in 2021, MRAC will assess conditions and evaluate potential remedies for addressing remaining TCE contamination in groundwater.

- Vapor Intrusion Investigation:

TCE vapors have been detected in sewer mains and shallow soil adjacent to subsurface utilities along the Main Street corridor and east along Brooks Street. In 2021, based on proximity to these source areas, MRAC and the Department identified 28 properties to consider for additional VI sampling. In 2017, MRAC and the Department identified eight properties for VI sampling. MRAC requested access to the eight properties to conduct VI sampling; property owners granted access to three of them. Of the three properties sampled, TCE was detected above the health-based screening level in one residential building with a basement foundation.

In December 2020, MRAC conducted additional sewer vapor sampling at manhole locations along Main, Mill, and Brooks streets to define the extent of sewer gas impacts. In 2021, MRAC will repeat sampling at those same locations during warm weather conditions. Based on those findings, additional properties may be identified for VI sampling.

In 2021, the Department will increase communication and education efforts to expand public awareness of potential health concerns associated with exposure to TCE contamination. The Department will also assist MRAC in gaining access to other potentially affected properties to conduct VI sampling. This round of sampling is intended to more clearly define the extent of TCE contamination from the site and to identify potential exposures to TCE above health-based levels.

For More Information

For more information regarding the site, contact the Department's Environmental Remediation Program at 573 751-4187. For health-related questions about TCE, contact the Missouri Department of Health and Senior Services at 573-751-6102.

Site Location Aerial Map

